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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/997,604	11/29/2001	Hiroshi Nemoto	791_065	5235

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EXAMINER
TSANG FOSTER, SUSY N

ART UNIT	PAPER NUMBER
1745	6

DATE MAILED: 03/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/997,604	NEMOTO ET AL.	
	Examin r	Art Unit	
	Susy N Tsang-Foster	1745	

-- The MAILING DATE of this communication appears on th cover sheet with the correspond nce address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 November 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *10-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. *09/406,592* .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *3,4* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Priority

1. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in parent Application No. 09/406,592, filed on 9/27/1999.

Information Disclosure Statement

2. The information disclosure statements (IDS) submitted on 11/29/2001 and on 8/23/2002 have been considered by the examiner.

It is noted that applicants cite copending applications 09/495,065 and 09/613,127 in the IDS submitted on 11/29/2001 and stated that copies of each of these applications can be found in the PTO file for the parent case. However, copies of these applications have not been filed in the parent case. Nevertheless, the cases 09/495,065 and 09/613,127 have been abandoned and it is therefore moot for the Examiner to considered these two cases for double patenting purposes of the present application.

Finally, applicants submitted a copy of an Office Action bearing a mailing date of August 20, 2002 from a corresponding Japanese patent application. However, this Office Action which appears to be a search report in the Japanese language is not considered by the Examiner because it is not in the English language and it is also not cited in the 1449 form with the appropriate date and source.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it

pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 12 and 19 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. In claims 12 and 19, the limitation "wherein said primary particles consist essentially of particles having at least one side of each flat crystal face of length of 1 μm or more" is not in the original disclosure.

The specification states (see page 4 of substitute specification) that the primary particles of the positive electrode active material preferably contain those primary particles in which at least one side of each flat crystal face has a length of 1 μm or more and does not state that the all primary particles of the positive electrode active material have at least one side of each flat crystal face of length of 1 μm or more. The Examiner interprets the term "contain" to be synonymous with the term "comprising". Furthermore, it would be impossible to produce a positive electrode active material consisting essentially of primary particles in which at least one side of each flat crystal face of the particle has a length of 1 micron or more since not all primary particles are substantially octahedral in shape constituted mainly by flat crystal faces since some particles formed may be round and not have a flat crystal face.

The specification also states (see page 6 of substitute specification) that the positive electrode active material is characterized by consisting of primary particles mostly having the substantially octahedral shape and that all primary particles need not have a substantially octahedral shape since the particle diameters of the raw materials, the impurities in the raw

materials, and the temperature distribution of the furnace during synthesis affects the growth of the crystal face and the growth of the crystal face may not take place uniformly.

Finally, the specification (see page 6 of substitute specification) also states that the particle diameters of the primary particles are obtained by analysis of the SEM image and the particle diameter measurement for individual particles are impossible. The specification also states (see page 7 of the substitute specification) that the amount of primary or secondary particles having particle diameters outside the specified ranges are at such a level not ordinarily detected in the methods of measurement for particle diameters mentioned in the specification. Hence, there is no experimental method of determining if all the primary particles are substantially octahedral in shape and even if there were all substantially octahedral, it is impossible to determine if all the primary particles have at least side of each flat crystal face of a length of 1 micron or more since some primary particle sizes are not detectable as stated in the specification.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 10-14 and 17-21 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over the JPO machine translation of JP 08-217452 A.

The JPO Machine translation of JP 08-217452 A discloses a method of manufacturing a lithium battery comprising the steps forming an electrode body by placing a positive electrode and a negative electrode in contact with a separator, the separator being positioned between the positive and the negative electrode so that the positive electrode is not in contact with the negative electrode (see Figure 1 and paragraph 81 of machine translation).

The JPO Machine translation of the reference also discloses that the positive electrode comprises a positive electrode active material which is composed mainly of Li and Mn where the Li/Mn ratio is larger than 0.5 and positive electrode active material has a cubic spinel structure (see paragraph 34 of machine translation) and primary particles mostly have a substantially octahedral shape constituted mainly by flat crystal faces (see Figure 4 and paragraphs 76 and 107) where the length of one side of the octahedron is 1 micron or more. The primary particle

size of the positive electrode active material can also be from 1 to 10 microns (see paragraph 56 of machine translation). Furthermore, since the positive electrode active material has the same particle shape, composition, and primary particle size as those disclose in the specification and being claimed in the instant claims, the primary particles inherently include particles having at least one side of each flat crystal face of length of 1 micron or more. The electrostatics and size of the primary particles inherently determine the size of the secondary particles and since the primary particle size range of 1 to 10 microns of JP 08-217452 A (see above) falls within the claimed range, the primary particles of JP inherently form secondary particles having a maximum particle diameter of 50 microns or less.

The positive electrode active material is formed of a raw material mixture comprising positive electrode precursor material comprising Li and Mn and heating the raw material mixture to a temperature and for a time which is effective to convert the raw material mixture into a positive electrode active material having the cubic spinel structure and primary particles having substantially octahedral shape (see paragraph 75 of machine translation).

8. Claims 15, 16, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over the JPO machine translation of JP 08-217452 A in view of Zhong et al. (US Pat. No. 5,700,597, hereinafter '597).

JPO machine translation of JP 08-217452 A discloses all the limitations of claims 15, 16, 22 and 23 except that the lithium secondary battery has a capacity of 2 Ah or more and that the lithium secondary battery is used in an electric vehicle.

Zhong et al. '597 teach a lithium battery as a high energy density source for an electric vehicle (col. 1, lines 20-25).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the lithium secondary battery in the electric vehicle because a lithium secondary battery has high energy density, is light weight, and would not cause exhaust air polluting substances during the operation of the electric vehicle.

It would have also been obvious to one of ordinary skill in the art at the time the invention was made to produce a lithium secondary battery having a capacity of 2Ah or more in order to operate a high energy consuming electronic device such as an electric vehicle since the power requirements of electronic devices differ and it would have been obvious to manufacture lithium batteries with varying capacities for different applications. A person of ordinary skill in the art would be motivated to and would be knowledgeable about how to scale up the amount of active material necessary in a lithium secondary battery in order to provide enough electricity to operate an electric vehicle or any other electronic device.

9. Claims 10-14 and 17-21 are rejected under 35 U.S.C. 102(a) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over GB 2328684 A.

GB 2328684 A discloses method of manufacturing a lithium secondary battery comprising:

forming an electrode body by placing a positive electrode and a negative electrode in contact with the separator, the separator inherently being positioned between the positive electrode and the negative electrode in a lithium secondary battery so that the positive electrode

is not in contact with the negative electrode to prevent short-circuiting and enable the battery to function (page 6 line 14 to page 7, line 11).

The positive electrode active material which is mainly composed of Li and Mn and has a cubic spinel structure, the primary particles of the positive electrode active material having an octahedron shape which inherently is constituted mainly by flat crystal faces (see pages 11, lines 1-3). GB 2328684 A also discloses primary particles having a particle diameter of 0.3 to 1 microns (page 11, lines 5-6) and the positive electrode active material has a Li/Mn ratio of larger than 0.5 (page 11, lines 7-8). The positive electrode material is also formed from a raw mixture comprising Li and Mn and heating the raw mixture to a temperature and for a time which is effective to convert the raw material into a positive electrode active material having the octahedron shape (see abstract).

GB 2328684 A does not specifically disclose that the primary particle size of the positive electrode active material with octahedral shape has at least one side of each flat crystal face a length of 1 microns or more, and that the primary particles form secondary particles having the maximum particle diameter of 50 microns or less.

Since the positive electrode active material has the same particle shape, composition, and primary particle size as those disclose in the specification and being claimed in the instant claims, for example, see page 7, lines 11-23, the properties cited in instant claims 10-14, and 17-21 are inherent in the positive electrode active material of GB 2328684 A. The electrostatics and size of the primary particles inherently determine the size of the secondary particles.

10. Claims 15, 16, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over GB 2328684 A in view of Zhong et al. (US Pat. No. 5,700,597, hereinafter '597).

GB 2328684 A disclose all the limitations of claims 15, 16, 22 and 23 except that the lithium secondary battery has a capacity of 2 Ah or more and that the lithium secondary battery is used in an electric vehicle.

Zhong et al. '597 teach a lithium battery as a high energy density source for an electric vehicle (col. 1, lines 20-25).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the lithium secondary battery in the electric vehicle because a lithium secondary battery has high energy density, is light weight, and would not cause exhaust air polluting substances during the operation of the electric vehicle.

It would have also been obvious to one of ordinary skill in the art at the time the invention was made to produce a lithium secondary battery having a capacity of 2Ah or more in order to operate a high energy consuming electronic device such as an electric vehicle since the power requirements of electronic devices differ and it would have been obvious to manufacture lithium batteries with varying capacities for different applications. A person of ordinary skill in the art would be motivated to and would be knowledgeable about how to scale up the amount of active material necessary in a lithium secondary battery in order to provide enough electricity to operate an electric vehicle or any other electronic device.

11. Claims 10-14 and 17-21 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Zhong et al. (US Pat. No. 5,631,104).

Applicants' claims are directed to a method of manufacturing a lithium secondary battery comprising a positive electrode active material which is composed mainly of Li and Mn and has

a cubic spinel structure and the primary particles of the positive electrode active material has a substantially octahedral shape constituted mainly by flat crystal faces.

Applicants disclose in the specification that the definition of "mainly composed of Li and Mn" means that part of the Mn in the lithium manganese oxide $LiMn_2O_4$ may be replaced by other elements such as an element selected from the group consisting of Li, Fe, Mn, Ni, Mg, Zn, B, Al, Co, Cr, Si, Ti, Sn, P, V, Sb, Nb, Ta, Mo, and W or that the lithium manganese oxide may contain B, Mo or W as an additive (see page 6, lines 18-25 to page 7, lines 5-10 of the specification). The applicants also prefer lithium manganese oxide to have a Li/Mn molar ratio of greater than 0.5 and examples include $Li(Li_xMn_{2-x})O_4$ where Mn is partly replaced by Li, and $LiM_xMn_{2-x}O_4$ wherein Mn is partially replaced by M that is a substitution element other than Li (see page 7, lines 11-23 of the specification). Applicants also disclose on page 11, lines 5-10 that production of the positive electrode active material of the present invention is conducted by firing a raw mixture consisting of given proportions of salts and/or oxides of various element including Li, Mn, and as necessary, a substitution element and addition elements in an oxidizing atmosphere at 700 to 900 °C for 5 to 50 hours.

Zhong et al. disclose a lithium secondary battery comprising a positive electrode active material with the formula $LiNi_zMn_{2-z}O_4$ where z can be 0.05, 0.1, 0.2, 0.3, and 0.5 (col. 8, lines 11-25) and Ni is the substitution element. The battery comprises an electrode group formed by placing a positive electrode and a negative electrode in contact with the separator, the separator being positioned between the positive electrode and the negative electrode so that the positive electrode is not in contact with the negative electrode (col. 6, lines 22-27 and Figure 1).

The positive electrode active material was synthesized with $LiMnO_2$, $NiNO_3$, and LiOH powders in appropriate amounts and heat treated at 750 °C in air for 4 hours and then the product was ground and mixed again followed by a second similar heat treatment for an additional 12 hours for z less than or equal to 0.3 (col. 8, lines 10-25). For the sample with z equal to 0.5, the first heat treatment lasted 16 hours and the second heat treatment was performed at 850 °C for 12 hours. Zhong et al. also disclose in general that the heating can be performed between about 750 and 900 °C and more than one mixing and heating step may be desirable (col. 4, lines 7-17).

Zhong et al. also disclose $LiCr_{0.5}Mn_{1.5}O_4$ as the positive electrode active material synthesized using an appropriate mixture of EMD, Cr_2O_3, and LiOH powders wherein the mixture was heat treated in air at 800 °C for 4 hours, ground, remixed, and heat treated again at 900 °C for 11 hours (applies to claim 10, col. 9, lines 32-37).

Zhong et al. also disclose $Li_{x+y}M_zMn_{2-y-z}O_4$ as the positive electrode active material where the crystal structure is spinel and M is a transition metal, $0 \leq x < 1$. $0 \leq y < 0.33$, and $0 < z < 1$ (see abstract). The positive electrode active material is prepared by mixing reactant powders comprising electrolytic manganese dioxide, a transition metal source, and a lithium source in a stoichiometric manner followed by heating the mixture in an oxygen containing atmosphere from 750-900 °C (col. 4, lines 4-17).

Since Zhong et al. disclose identical synthesis conditions and formulas for the positive electrode active material in the lithium battery as discussed above [Zhong et al.'s formula (see abstract) encompasses the formulas $LiM_xMn_{2-x}O_4$ and $Li(Li_xMn_{2-x})O_4$] as those of the applicants, the properties cited in the instant claims 10-14 and 17-21 are inherent in the positive electrode active material of Zhong et al.

12. Claims 10-14 and 17-21 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Manev et al. (US Pat. No. 5,961,949).

Manev et al. disclose a lithium secondary battery comprising a positive electrode active material with the formula $Li_{1.025}Mn_{1.975}O_4$ having spinel structure and a mean particle size distribution of 2 microns (see col. 6, lines 5-10). The positive electrode active material was synthesized by heating 500g of ground MnO_2 and LiOH (raw material comprising Li and Mn) at a molar ratio of 2Li:Mn =1.05 and the mixture was fired at 750 °C for 48 hours (col. 6, lines 1-5). Manev et al. also disclose that the mixture is generally fired in the presence of a gas flow such as air or a gas mixture containing from 5 to 100 percent oxygen by volume, which is an oxidizing atmosphere (col. 4, lines 45-48). A lithium secondary battery also inherently comprises an electrode body formed by placing a positive electrode and a negative electrode in contact with the separator, the separator inherently being positioned between the positive electrode and the negative electrode so that the positive electrode is not in contact with the negative electrode so that a short-circuit does not occur and enable the battery to function.

Since Manev et al. disclose identical synthesis conditions and formula for the positive electrode active material in the lithium battery as those of the applicants as discussed above, the properties cited in the instant claims 10-14 and 17-21 are inherent in the positive electrode active material of Manev et al.

13. Claims 15, 16, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhong et al. (US Pat. No. 5,631,104, herein after '104) in view of Zhong et al. (US Pat. No. 5,700,597, hereinafter '597).

Zhong et al. '104 disclose all the limitations of claims 15, 16, 22, and 23 (see above) except that the lithium secondary battery has a capacity of 2 Ah or more and that the lithium secondary battery is used in an electric vehicle.

Zhong et al. '597 teach a lithium battery technology as a high energy density source for an electric vehicle (col. 1, lines 20-25).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the lithium secondary battery in the electric vehicle because a lithium secondary battery has high energy density, is light weight, and would not cause exhaust air polluting substances during the operation of the electric vehicle.

It would have also been obvious to one of ordinary skill in the art at the time the invention was made to produce a lithium secondary battery having a capacity of 2Ah or more in order to operate a high energy consuming electronic device such as an electric vehicle since the power requirements of electronic devices differ and it would have been obvious to manufacture lithium batteries with varying capacities for different applications. A person of ordinary skill in the art would be motivated to and would be knowledgeable about how to scale up the amount of active material necessary in a lithium secondary battery in order to provide enough electricity to operate an electric vehicle or any other electronic device.

14. Claims 15, 16, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Manev et al. (US Pat. No. 5,961,949) in view of Zhong et al. (US Pat. No. 5,700,597, hereinafter '597).

Manev et al. disclose all the limitations of claims 15, 16, 22, and 23 (see above) except that the lithium secondary battery has a capacity of 2 Ah or more and that the lithium secondary battery is used in an electric vehicle.

Zhong et al. '597 teach a lithium battery as a high energy density source for an electric vehicle (col. 1, lines 20-25).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the lithium secondary battery in the electric vehicle because a lithium secondary battery has high energy density, is light weight, and would not cause exhaust air polluting substances during the operation of the electric vehicle.

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Conclusion

15. Any inquiry concerning this communication or earlier communications should be directed to examiner Susy Tsang-Foster, Ph.D. whose telephone number is (703) 305-0588. The examiner can normally be reached on Monday through Thursday from 9:30 AM to 8:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at (703) 308-2383. The phone number for the organization where this application or proceeding is assigned is (703) 305-5900.

The fax phone numbers for the organization where this application or proceeding is assigned is (703) 872-9310 for regular communications and (703) 872-9311 for After-Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

st/26 February 2003

Susy Tsang-Foster